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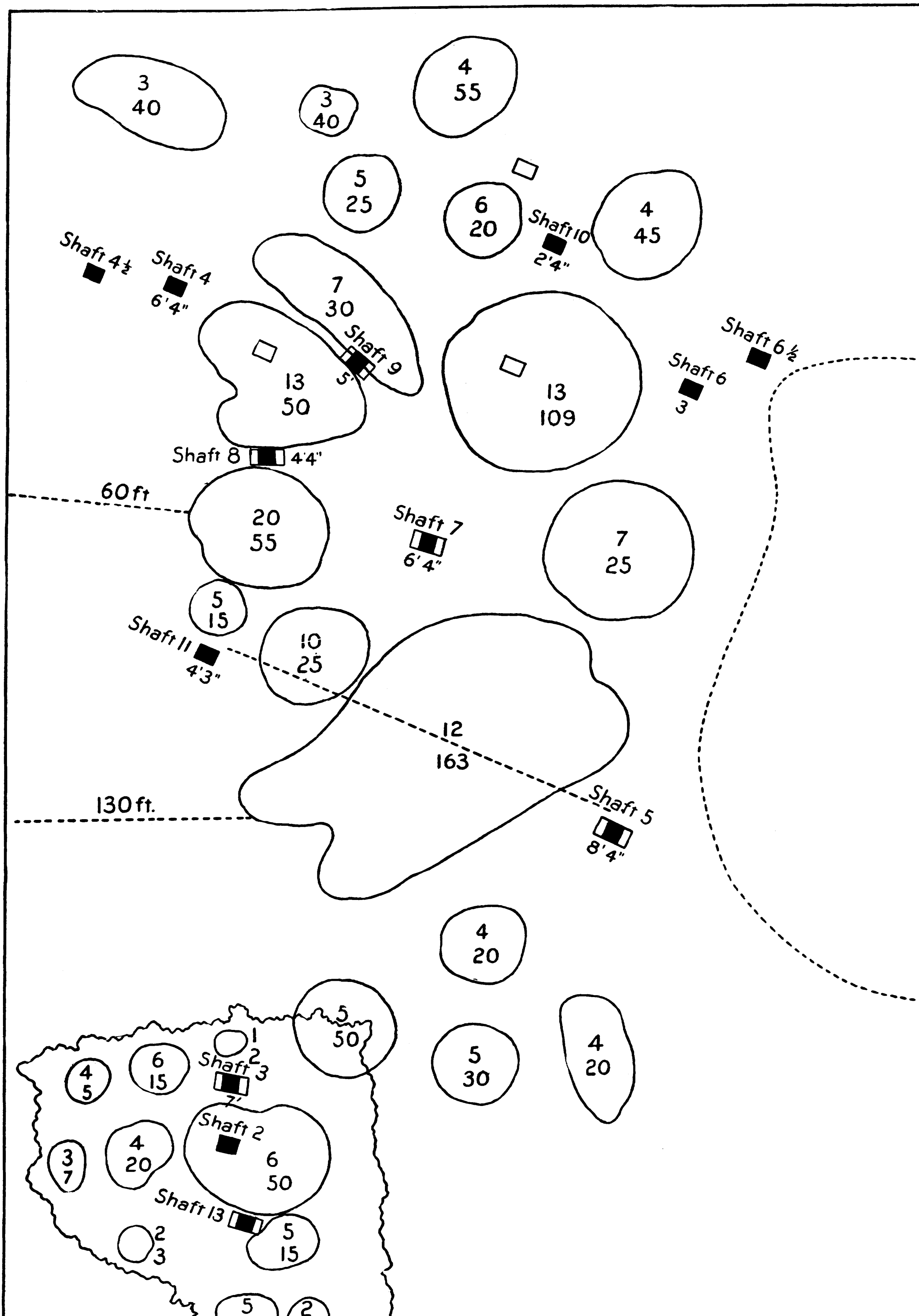
INDIAN JASPER MINES IN THE LEHIGH HILLS.

BY H. C. MERCER.

Expeditions sent out by the University of Pennsylvania in the summers of 1891 and 1892 discovered or explored nine ancient jasper quarries in Bucks, Lehigh, and Berks counties, Pennsylvania. The outcrops of the well-known Indian blade material occurred generally in connection with veins of hematite and followed the trend of the Lehigh hills from the Delaware almost to the Schuylkill. Messrs. Charles Laubach and J. A. Ruth, of Riegelsville, had known the nine flake-strewn pits on Rattlesnake hill, about a mile from the Delaware, for several years, and the former called our attention to them in 1891.

The twenty pits at Saucon creek (Wieder farm, two miles west of Limeport, Lehigh county, Pennsylvania) were discovered by Mr. Laubach and myself in 1891, on following the clue of a farmer who described the dump-heaps as "Indian mounds." I discovered the ten diggings on the Mast farm, a mile and a half south of Limeport, in 1891. The existence of the sixty hollows at Vera Cruz, Lehigh county, Pennsylvania, had been suspected by Mr. A. F. Berlin, of Allentown, and his suggestion led me to them in 1892, to the one hundred and thirty-eight at and about the C. C. Miller farm, at Macungie (Lehigh county, Pennsylvania), on September 20, 1892, and to the five at Feuersteinberg (near Bowers station, Berks county, Pennsylvania) shortly after. I discovered the two pits at Coopersburg (Bucks county, Pennsylvania) and the twenty at Leinbach's mills (Berks county, Pennsylvania) in 1892.

All the diggings, except those at Saucon creek, Coopersburg, and Long Swamp, are at ill-watered and rather uninhabitable sites. The pits, save the larger ones at Vera Cruz and Macungie, are small in comparison with the Flint Ridge (Ohio) workings, while the chips, where cultivation reveals them, are coarse and the material comparatively intractable. "Turtlebacks" are very rare in comparison with the numbers found at Flint ridge and at Piney branch (District of Columbia).


3
40
3
40
4
55
5
25
6
20
Shaft 10
2'4"
4
45
Shaft 4½
Shaft 4
6'4"
7
30
Shaft 9
5'
13
50
13
109
Shaft 6½
Shaft 6
3
Shaft 8
4'4"
60 ft
20
55
Shaft 7
6'4"
7
25
5
15
Shaft 11
4'3"
10
25
12
163
130 ft.
Shaft 5
8'4"
4
20
5
50
5
30
4
20
4
5
6
15
1
2
Shaft 3
7'
Shaft 2
6
50
3
7
4
20
Shaft 13
2
3
5
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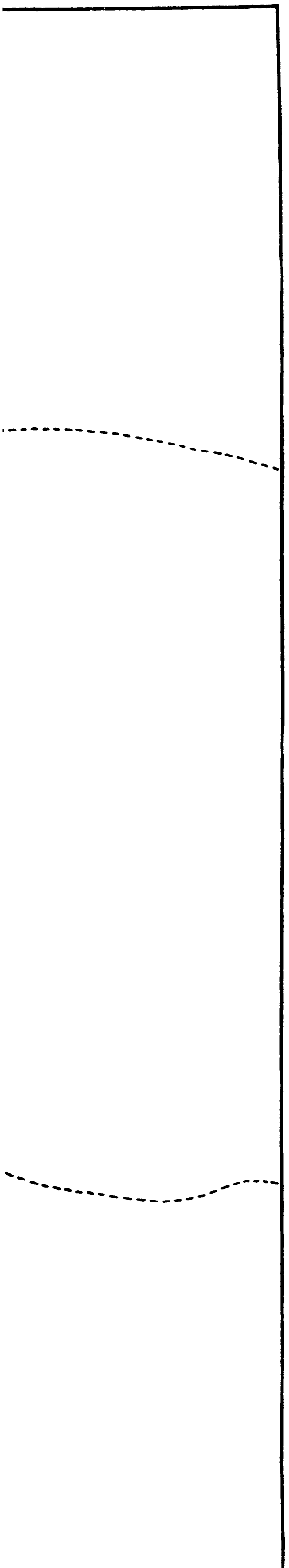
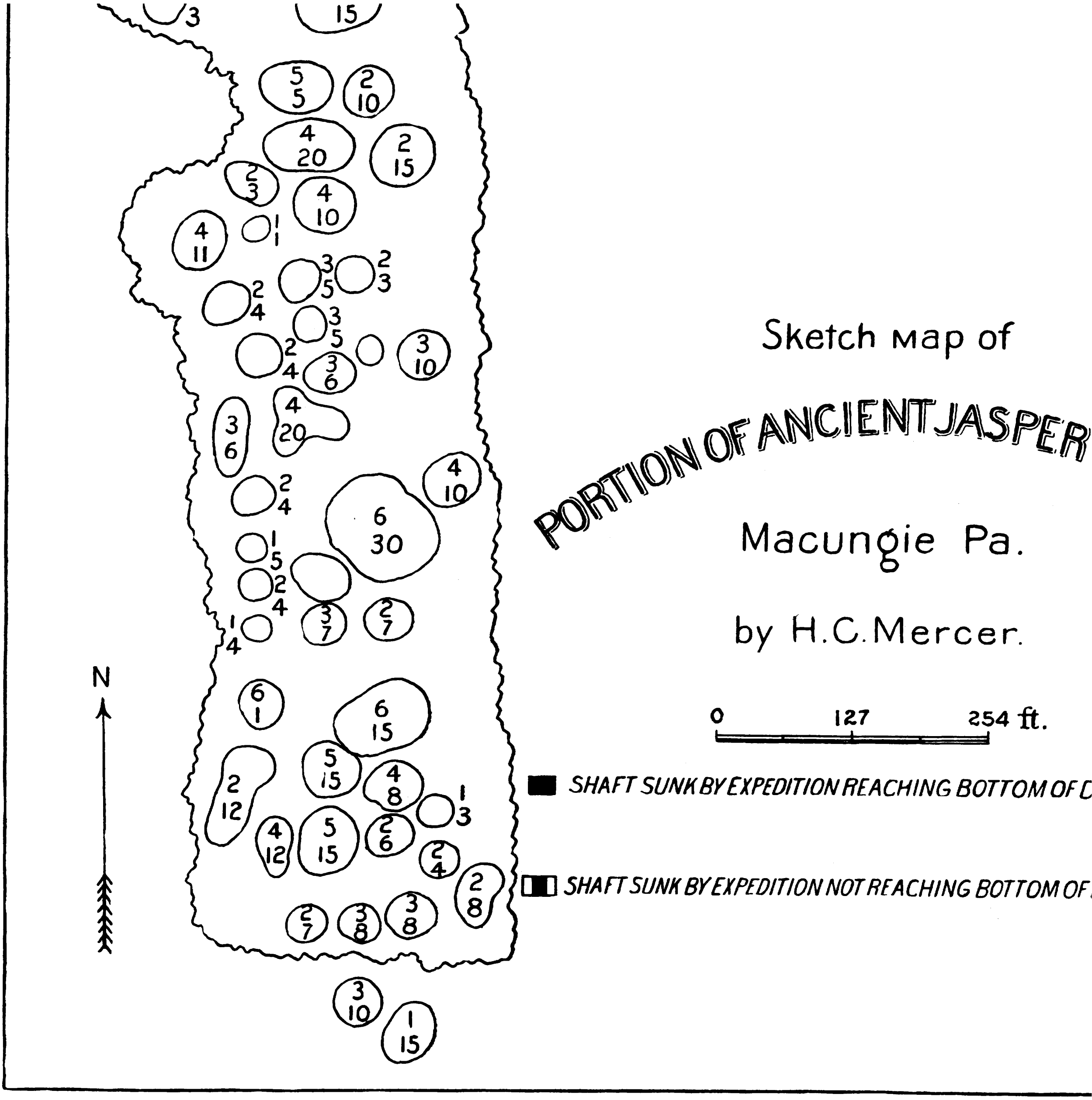
2





Sketch map of

PORTION OF ANCIENT JASPER

Macungie Pa.

by H.C. Mercer.

N
0
127
254 ft.
SHAFT SUNK BY EXPEDITION REACHING BOTTOM OF
SHAFT SUNK BY EXPEDITION NOT REACHING BOTTOM OF

PER QUARRIES

ft.

OM OF DISTURBANCE.

TOM OF DISTURBED SOIL.

At Saucon creek some arrow-head workshops and a small mound in a neighboring swamp yet remain to be fully explored, but Macungie, explored in September and October, 1892, with its 108 pits and its half-wooded area of about six acres, will serve as a type of all the quarries.

The Possibility of Sink-holes.

Where there is jasper there is limestone, and where limestone, sink-holes. We were on the north slope of the Lehigh hills and hence overlooking the valley which, margined west by the Alleghanies and east by highlands variously named, stretches from New York to Alabama.

Rain-water, with its carbonic acid trickling through the jasper-bearing, clay-bedded magnesian limestone under our feet, had made caves, and their roofs had fallen in, so there were sink-holes in the neighborhood. Four small depressions of the surface, like large woodchuck holes among the tree roots, at the southwest corner of the quarries, lacking dump-heaps, looked like sink-holes, so that there seemed a chance that men had not dug the 108 holes outright, but had scratched upon the slopes of natural funnels against already-denuded jasper layers. But eight shafts sunk here and there in the pit margins through disturbed soil, charcoal, and refuse, sometimes reaching the undisturbed stratum of forest mould (as at shafts 4, 6, 10, and 11; see sketch map) and sometimes not getting below the disturbance (as at 7, 5, 13, and 9), satisfied us that the margins were not level as at the sink-holes but artificially piled-up heaps.

The shallowest dumps are at shafts 6 (3 feet) and 10 (2 feet 4 inches). Then comes 11 (4 feet 3 inches) and 4 (6 feet 4 inches), while at 5 there is no bottom at 8 feet 4 inches; none at 7 at 6 feet 4 inches; none at 3, at 7 feet; at 8, at 4 feet 4 inches, or at 9 at 5 feet. The small trenches 4½ and 6½ at distances of 60 and 30 feet from the pit margins showing no disturbance prove that the dumps did not extend so far. Moreover, a glance at the sectional drawings, taken from shaft 11 to shaft 5 (see map), demonstrates that in two cases, which fairly represent the measured instances, the cubic contents of the dumps equaled that of the holes; and we had done enough to prove that if we could have planed down the dumps to the original surface line the pits would have been about level. The depressions were therefore not sink-holes, but had been dug by men.

An Unsuspected Excavation.

But, as observed before, there were four small real sinkings, and the only way to explain them, and Mr. Miller's statement that they had caved down in the last ten years, and that plow-horses had become entangled in similar ones in the next field, was to follow down the deepest of them, 2 feet in diameter, 3 feet deep, and extending sidewise under the roots. Our shaft 12 (not given on the map) showed that for 14 feet down at this sink, and continuing 11 feet below its bottom, the yellow soil containing charcoal and chips has been disturbed. At 8 feet we encountered a limestone ledge and followed the traces of ancient work downward over its edge until at 14 feet these seemed to slope away diagonally out of reach of our shaft. If we are to believe James Garr, who stated that he sunk a pit in another sink about 30 feet farther to the west and found traces of disturbance to a depth of 40 feet, when he struck the limestone ledge above mentioned, we had worked into an Indian digging about 40 feet in depth and probably 100 feet in diameter that had been completely filled up by the ancient workmen.

But, without using Garr's testimony and refraining from speculation as to the real size of the pit, it is certain that the sink had fallen and we had worked through level ground already dug to an unknown depth, and whether the sink testified to a cave somewhere in the limestone below or a cavity left by the Indians as they piled in the transported earth, it told us certainly more than we bargained for and detracted nothing from the magnitude of the ancient labor.

The Diggings the Work of Indians.

Having settled that the pits are artificial; that notwithstanding the limestone in the neighborhood it is not reasonable to suppose that any of them could have been in part or wholly sink-holes (since every depression has its dump and the dumps are about sufficient to level the whole area); that inferably all of the pits had been more or less filled in with excavated earth by the quarrymen; that an area now level had been worked to a depth of 14 feet at least, and that finally it may be safe to say that double the work has been done suggested by the appearance of the surface, it remains to ask when and how were the pits dug and who dug them?

An old stump with 195 rings, on the side of a pit at Vera Cruz, and a tree nearly four feet in diameter cut down by Mr. C. C. Miller at Macungie in the bottom of a depression, would put back the abandonment of work in these two shafts to about 1680–'90; and that all are the work of Indians is proved by (*a*) two fragments of polished celts and one perfect and three broken arrowheads found by me on the edges of the diggings; (*b*) several small thinned-down blades found near the pits; (*c*) an arrowhead factory, where I found two fragments of finished arrowheads in the refuse, situated near a brook about three-eighths of a mile from the jasper outcrop; and lastly (*d*) by the fact that the material found and worked in the pits is jasper, a stone in continual use by early Indians, and worked fragments of which strew every village site in the Delaware valley.

The Method of Excavation.

Admitting, then, that no mysterious or unknown race made the pits, vast as the work is, but the Indian, once supposed incapable of sustained labor, the Red man of the grooved stone axe, polished celt, banner stone, and gorget, as encountered by Campanius and Kalm, the next question is, how was the labor accomplished?

This can be answered to some extent, but not fully, by a study of shaft 2, sunk down to the undisturbed bottom of one of the pits (see map and Plate 1). Lying on the unworked clay, at a depth of 18½ feet, was a large disc-shaped implement of chipped limestone a foot in diameter and well worn on its cutting edge.* At the fourteenth foot, among the refuse, a smaller tool, similarly worn, of quartzite and a rude point (of limestone) were found. While at the bottom again two cavities in the clay produced, on running in plaster of paris, the fac-similes of two sharpened wooden billets (long since rotted away and leaving only their moulds), one about 6 inches in diameter and of unknown length, as the upper part was destroyed in digging, the other with a diameter of about 2 inches and 2½ to 3 feet long. (See Figs. 1 and 2.)

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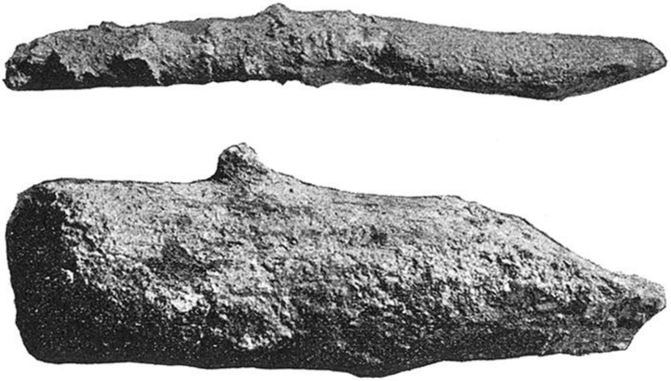
* I regret that I have been unable to publish illustrations of this and the other interesting stone specimens found in shaft 2; also drawings of the oven there discovered, and of the arrangement of layers in shaft 12.

It is needless to go into details as to bark, twigs, slight charring at the ends, etc. The unique specimens now at the University of Pennsylvania's museum of American archeology speak for themselves. Granted that the Indian quarryman used copper tools not yet found, or pick-axes of deer antlers like the ancient flint-workers of Brandon, in England, can we suppose that he did not employ poles of various sizes charred, and sharpened like these with stone tools, both to scratch and delve the ground and pry up the bowlders? And so, whatever we say of the quartzite implement at the fourteenth foot, shall we doubt that the ponderous chipped disc, showing unmistakable marks of usage, was handled as a digging tool in the fine yellow clay on which we found it?



Figs. 1 and 2.—Pointed wooden billets, showing work of ancient implements, recovered as plaster casts from bottom of excavation. Depth, larger, 17¾ ft.; smaller, 13½ ft.

The ocherous clay, or decomposed diorite interbedded with the limestone, at Macungie, is often highly tinted with yellow, that at Vera Cruz is sometimes red, pink, and bluish. Manganese is abundant at both places, besides a talcose slate that cuts easily, when freshly dug, into pipes and amulets; but as yet we have no proof that the excavations were made or altered for any of these substances. Thus far the study of the quarries prove that jasper was the material sought, and the questions remain: In what state did the Indian find it? How did he take it from the earth, and how reduce it to his desired shape?

A shaft of the Durham Iron Company encountered a solid vein of red jasper under the Indian jasper quarries, at Rattlesnake Hill, at a depth of about 100 feet, and at Macungie Mr. James Garr says that he reached a solid yellow ledge of it in his shaft, sunk for curiosity, in one of the pits at 30 feet beneath the surface. But our shaft, since it did not reach the undisturbed edges of the old hole, did not determine that no ledge existed, though it did prove that nodules were frequent. These are found on the surface, varying in diameter from 2 inches to 4 feet, at all the diggings; and one, with its thick, silicious coat, about 3 inches in diameter, was excavated at a depth of 19 feet from the undisturbed clay at the bottom of our largest shaft. Sometimes partly chipped, sometimes untouched, these nodules are found scattered everywhere in the dumps.

Yet as they, and the chips and splinters that accompany them, here bear only a proportion of about 10 per cent. to the clay and are pretty evenly distributed through the mass, it is evident that the pits were to no great extent worked out of a solid ledge. If they had been, the constitution of the dumps would have betrayed it. We should have found more stone than clay in them. But we always found less, and very much less.

The evidence thus far indicates that after rolling away the surface nodules those lying deeper were pried up one by one with sharpened poles and the surrounding clay scraped away until the pits were made.

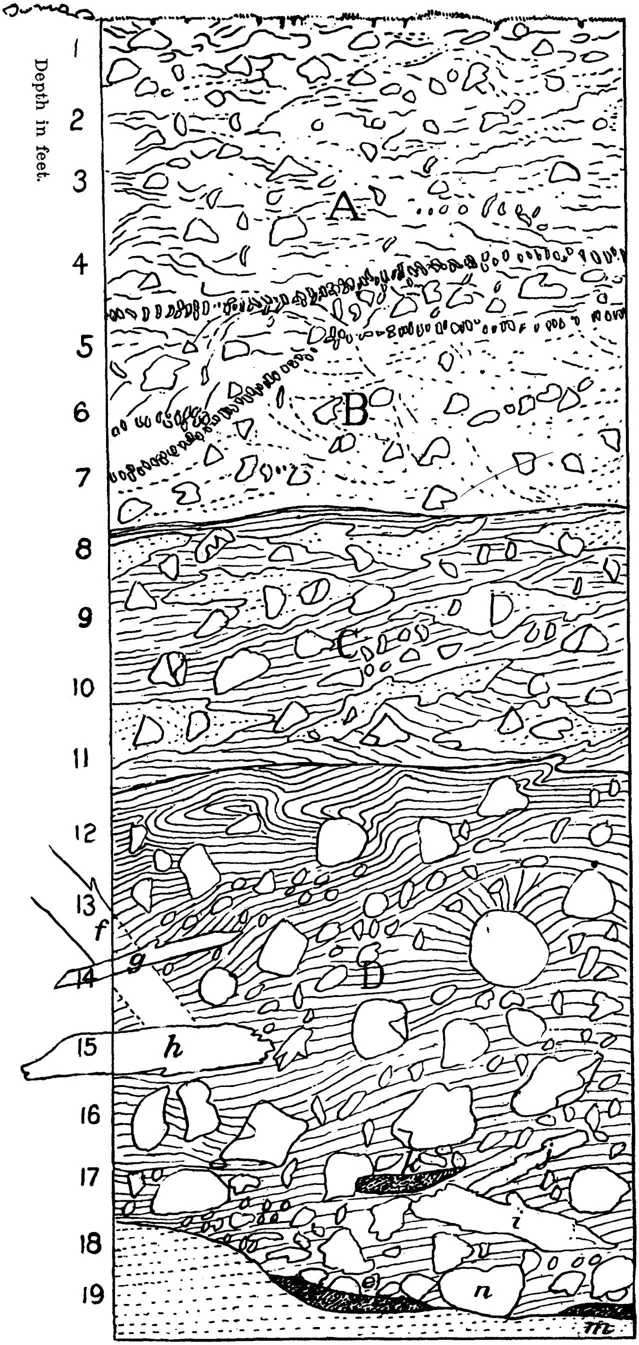
Traces of Fire.

Scattered fragments of charcoal were scarce in shaft 12 below the ninth foot, but all the other diggings and dumps were sprinkled thick with bits of charcoal. About 20 per cent. of the chips and 10 per cent. of the large blocks were reddened as if by fire, while reddened fragments were abundant in all the fire-places. Nothing was surer than that fire had played a great part in the quarrying process; but while four fire-places examined showed no trace of cooking, they also gave no sure clue to their purpose, and there would have remained a doubt whether the fires had not been built for warmth had not a fifth hearth discovered in shaft 2, at a depth of 15 feet, seemed to settle the question. It was an oven regularly built of blocks of jasper and contained a mass of charcoal and ashes (see Pl. I). The fact that the sides of the blocks were reddened, and several had already split through the middle, while the interstices were filled with fine splinters, offered conclusive evidence that the quarrymen had built the fire to fracture the blocks, which measured 2 feet, 1½ feet, 6 and 7 inches respectively in diameter.

My experiments proved (*a*) that if a large block of 2 feet in diameter is thoroughly heated on a wood fire it breaks into numerous pieces at a moderate blow; (*b*) that only the fragments near the fire are reddened; (*c*) that the fragments lose their original gloss by the process. The luster, however, seemed to be regained by long burial in damp clay, as was indicated by the high-polished fracture of some of the reddened chips found on the fire-places. Moreover, many of the worked forms gathered on the surface had been probably fire-reddened, and it is not unlikely that the Indian could have so heated the blocks as to reach their purer parts without spoiling the whole, while many of the large and coarse blocks might have been fire-fractured to get them out of the way.

The Transport of Jasper from the Quarry.

Lastly, what was done to the jasper after excavation? This brings us to the chips and refuse found in the shafts and on the surface. (1) In the large shaft 2, two leaf-shaped forms of jasper ("turtlebacks") were found at the eleventh and two were found at the sixteenth foot, none of them showing signs of use on their cutting edges. In shafts 5 and 7 I found hammer-stones at the first foot, in shaft 12 another at the fourteenth foot, and in the fields close to the pits 253 leaf-shaped forms and 55 hammer-stones. Certainly 70 per cent. of the hammer-stones were broken, a very few were made of sandstone, about 10 per cent. were of jasper, but most consisted of quartzite, or its equivalent, metamorphosed Potsdam sandstone, pebbles no doubt found in the beds of neighboring streams or



A—Clay and loam, jasper chips and charcoal.

Jasper chips.

Jasper chips.

B—Yellow ocherous clay, mixed with chips, charcoal, etc.

C—Brown earth or loam, interlaid with masses of yellow ocherous clay like B; the whole mixed with chips, nodules, and scattered bits of charcoal; 11th foot, blocked-out jasper blade; also small jasper blade.

D—Dark-brown earth or clay, mixed with smaller lumps of yellow clay, jasper nodules, charcoal, and containing: *e*, *k*, *m*, fire-places; *f*, mould of tree; *h*, charred mould of tree; *j*, charred mould of branch; *i*, mould of tree sharpened at end (Fig. 1); *g*, mould of sapling sharpened at end (Fig. 2); and *n*, large stone implement; 16th foot, large quartzite "turtle-back;" also blocked-out blade of jasper; also small blocked-out blade of jasper; 16th foot, small piece of unio shell.

Undisturbed pure yellow and white ocherous clay at bottom, 18½ ft. down, in which one small jasper nodule was found.

PLATE I.—Section exposed on west face of Shaft 2, showing arrangement of refuse layers, fire sites, pointed wooden billets, etc.

where on hillsides marine forces had rolled them since Laurentian times. Many of them were well battered and many so reduced by successive blows following one plane of their circumference as to have the characteristic appearance of heavy discs, while it is important to note that none of them, with two or three doubtful exceptions, are pitted on the sides.

The refuse may be divided into four classes:

(*a.*) Chips and fragments of no inferable design.

(*b.*) Rough leaf-shaped forms not betraying their artificiality in their fractures, but only in their comparatively great numbers. Had the Indian been pounding on argillite pebbles, the blows would have left their mark in a series of conchoidal fractures, and, as in the quartzite specimens from Piney branch, the marred pebble surface would have told the tale. But here the cross-grained jagged edges often explain little, and it is only after we have visited other jasper outcrops where no such fragments as these exist and convinced ourselves that frost does not even account for the chips, much less for the hammer-stones, in a word, after we have gathered these specimens by the dozen, thrown them away and picked them up again, that we are finally convinced, in spite of the criticisms of friends, that nearly as many blows have been expended upon them as upon the ordinary " turtleback," and that it is only the coarseness of the material that hides from us in these ruder instances the handiwork of man.

(*c.*) The " turtlebacks." About these there is no doubt. We need no context to settle their artificiality; each, big or little, vouches for itself, as do the similar forms in argillite and sandstone from the Delaware or Susquehanna beaches. Standing in a ratio of about 1 to 15 of the former class, they are not nearly as common as at Flint ridge and Piney branch. To gather the 153 that we found on six or seven occasions, varying from 1 to 5 inches in length, required careful, painstaking search; still they were there, and it is the question of their purpose that concerns us most. The Indian made them, either as finished or unfinished implements, for they may not be assigned to chance or symbolic use. We cannot, however, here use the argument that their mere presence proves their intentional abandonment, for, being as scarce as arrow-heads in an " Indian field," they might, like the latter, have been lost. All show design, all take the leaf-form, and all aim at a point and a cutting edge. That partly thinned blades occur among them proves here, as at the other quarries, that these jasper "turtlebacks" are inchoate Indian spears, knives, or scrapers, unfinished, rejected, or lost; but which were "rejects," and which were lost, which were too cross-grained to be thinned down, and which were not, we leave to the Indian now living, who forty years ago was making stone arrow-heads on the Sacramento, to tell us. The point is almost immaterial; the main fact remains that all obviously are steps in the process of fashioning.

(*d.*) The thinned-down blade, still very rude but of recognizable Indian pattern, of which we found 29 specimens, 7 were were only fragments, 4 would have measured 5 inches in length and done for large spears, 14 would have worked into arrow-heads. There was nothing like a buried cache of blanks to prove exactly how far the chipping work was carried at any one time at the quarries or that it always stopped at the same degree of finish. Sometimes it may have been large or small thinned ill-worked blades that were bundled up and carried off; sometimes pressure-finished knives or spears; sometimes back-breaking loads of "turtlebacks" themselves, heavy but still workable; while that the Indian sometimes carried away still heavier raw lumps is proved by a mass of native brown jasper weighing eight pounds found on the village site of upper Blacks' Eddy, ten miles from the nearest (Durham) quarry, and a smaller fragment noticed at the Frys' Run site, about five miles from the Durham diggings. On the other hand, two perfect arrow-heads of jasper and a curious notched jasper form (which I suggest was used instead of the notched bone in the finer chipping) found close to the pits seem to prove that the process was sometimes completed there, while two broken quartzite arrow-heads, a third of argillite, and a fourth of quartz point to material found and work done elsewhere. But granting all this, the immensely greater proportion of rougher forms places it beyond a doubt that the rude preliminary work above described and little else characterized the immediate quarry sites.

That the traces of thinned blades were so much rarer than the "turtlebacks" in the refuse was doubtless because they had reached a stage when they were more valuable to the maker, and when they would have been discarded far less often than the rough half-tested forms. That they represented the later steps in the work of which the "turtlebacks" were the beginnings, there could be no doubt.

A few blows of the pebble-hammer gave us the rough, leaf-shaped profile; others more careful and probably dealt with the smaller hammers produced the unmistakable closer chippings all round; then, if the mass, ceasing to be tractable, were not thrown away, still finer work—possibly pressure, was applied until the "turtleback" was thinned down to the last-mentioned form—which already in some cases as well finished as the stone knives found in Arizona cliff dwellings, still lacked the final notching and finishing touches to specialize it into a completed spear.

The Quarries as Places of Habitation.

Quarrymen dwelt at the diggings for prolonged intervals—must have done so. How can we doubt it when we consider the amount of work done, which, at Macungie, may be roughly estimated at one million cubic feet of earth excavated and carried from pit to pit. On the bottom of one of the shallow pits at Durham I found the jaw and teeth of a deer mingled with charcoal and ashes, and, as the quarrymen must have eaten while they worked, similar fire sites must exist at Macungie. The three fragments of polished celts above mentioned found with the refuse, the four arrow-heads of foreign material and a fragment of unio shell found in shaft 18, attest habitation, and no doubt systematic search will discover pottery and all the other traces of regular Indian occupation near the pits.

Yet, admitting all this, when we consider how scarce these relics are and realize the position of the quarries, sometimes on high slopes and frequently in exposed positions and removed from the spring, that desideratum of the Indian village, we see plainly that they were rather mining camps than village sites.

Resemblances of the Quarry Turtleback.

But the study of these quarries brings us beyond the bounds of Indian archeology and the interest that clings to their flaked stones lies not in what these are, but what they can tell us about the flaked stones of other ages and peoples.

The chief thing to be noticed about them is, and recent discussion has impressed the fact, that they resemble the so-called implements of alleged older peoples in the Age of Stone.

They look like Trenton specimens, like certain European neolithic quarry specimens (Spiennes and Cissbury), like certain among the Somme, Thames, Marne and Onse valley specimens, and when we have realized this we see that the important thing about quarries all over the world is not the "turtlebacks," for they seem common to many and characteristic of none, but the resultant blade for which the "turtlebacks" were made.

Fortunately we can find—if we look hard enough—arrowheads (Flint Ridge, Saucon creek, and Macungie); pitted hammerstones (Gaddis' Run), pointed wooden billets (Macungie), polished celts (Macungie and Grimes' Graves), pottery (Spiennes), and fossil bones (Abbeville), at such places to tell whether they are the workshops of North American Indians, of the Neolithic celtmakers of Belgium, or of the Drift Men of France and England, but outside of these culture and age tests we find a site marking difference of *result* aimed at in the different workshops named.

At Spiennes the "turtleback" turned to a celt; at Abbeville, if it turned to anything, to a *coup de poing;* at the North American quarries to a cache-blade spear or arrow-head, while, if we could see the Mount Hope greenstone quarry or the Gippsland River-bed workshops in Australia (R. Brough Smith's "Aborigines of Victoria," p. 378), we should no doubt see it again fading into the so-called "tomahawk."

While, then, in three epoch-denoting classes of workshops—European drift, European neolithic, and North American Indian—we have the "turtleback," we must allow that the fact that a thing is a "turtleback" is neither for or against its antiquity. Bereft of its fellow-specimens from the quarry or workshop, wanting therefore a clue as to the intent of its maker, without geological horizon or associated relic, it must remain dateless and unlabeled.

Returning to the Lehigh Hills' quarries, a study of their topography makes us believe that the Indian dwelt some time in the valley of the Delaware before he discovered and worked them, and meanwhile as an inhabitant of the larger streams, chipped blade material in the form of beach-exposed pebbles. The recent discovery of argillite quarries at Gaddis Run, on the Delaware, in May, 1893 (after the preceding pages were written, *i. e.*, in November, 1892), and the study of the neighboring river shores seemed to divide the large group of argillite "turtlebacks" there found into two classes—those of the quarry and those of the riverside, distinguishing between quarry chipping places, where "turtlebacks" were made at a late period of Indian occupancy systematically and by skilled workmen from material excavated inland, and riverside chipping places of an older time, where "turtlebacks" were made along the riverside from surface material there at hand.

And these riverside workshops it was which, when we came to push investigation abroad and into earlier geological horizons, seemed analogous to the specimen-bearing sites of the drift.